



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

Address: COMMISSIONER FOR PATENTS

P.O. Box 1450

Alexandria, Virginia 22313-1450

www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/761,381	01/22/2004	Shinji Murai	247955US2SRD	2421
22850	7590	07/22/2008		
OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314				
EXAMINER				
TRINH, THANH TRUC				
ART UNIT		PAPER NUMBER		
1795				
NOTIFICATION DATE		DELIVERY MODE		
07/22/2008		ELECTRONIC		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentdocket@oblon.com

oblonpat@oblon.com

jgardner@oblon.com

### Office Action Summary

**Application No.**

10/761,381

**Applicant(s)**

MURAI ET AL.

**Examiner**

THANH-TRUC TRINH

**Art Unit**

1795

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 30 April 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-7 and 9-15 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7 and 9-15 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/CDC)
- Paper No(s)/Mail Date \_\_\_\_\_

- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
  2. Ascertaining the differences between the prior art and the claims at issue.
  3. Resolving the level of ordinary skill in the pertinent art.
  4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
1. Claims 1-2, 4-6 and 9-15 are rejected under 35 U.S.C. 102(b) as being anticipated by Kang et al. ("Enhanced Stability of Photocurrent-Voltage Curves in Ru(II)-Dye-Sensitized Nanocrystalline TiO<sub>2</sub> Electrodes with Carboxylic Acids", Journal of the Electrochemical Society, Vol. 147 (8), 2000, pages 3049-3053) in view of Wariishi et al. (US Patent 6376765)

Regarding claims 1, 4, 11-14, Kang et al. discloses a dye-sensitized solar cell comprising a semiconductor electrode containing a dye (ITO, TiO<sub>2</sub> particles and RuL<sub>2</sub>(NCS)<sub>2</sub>·2H<sub>2</sub>O) and a carboxylic compound, wherein the dye and the carboxylic compound are carried on a surface of the semiconductor electrode; a counter electrode (Pt); a liquid electrolyte composition provided between the semiconductor electrode and

the counter electrode and comprising an electrolyte that contains iodine ( $I_2$ ) and  $LiI$  (See "Experimental" and "Results and Discussion" sections of Kang et al.). Kang et al. further teaches the carboxylic compound is selected from the group of acetic acid, butyric acid, benzoic acid. (See Table 1 on page 3052).

The difference between Kang et al. and the instant claims is the requirement of molten salt of iodide in the electrolyte.

Wariishi et al. teaches a photoelectric conversion device (or dye-sensitized solar cell) comprising electrolyte composition containing molten salt of iodide (See col. 5 lines 25 through col. 7 lines 15; col. 1 lines 56 through col. 4 lines 58)

It would have been obvious to one skilled in the art at the time the invention was made to modify the device of Kang et al. by using molten salt of iodide in the electrolyte composition as taught by Wariishi et al. because Wariishi et al. teaches the electrolyte composition containing molten salt of iodide would provide an electrolyte composition excellent in durability and a charge-transporting capability, and give a photoelectric conversion device exhibiting high durability and excellent photoelectric conversion properties. (See col. 1 lines 57-67)

Regarding claim 2, Wariishi et al. teaches using a gelling agent in the electrolyte composition. (See col. 19 line 53 through col. 20 line 23)

Regarding claim 4, Kang et al. teaches including inorganic salt of iodide ( $LiI$ ) in the electrolyte composition (See "Experimental" of Kang et al.). Wariishi et al. also

teaches including inorganic salt (LiI, NaI, CsI,  $CaI_2$ ...) in the electrolyte composition.  
(See col. 21 lines 58-67)

Regarding claim 5, Wariishi et al. teaches using electrolyte composition contains a viscosity lowering agent containing salt of nitrogen-containing heterocyclic compound (See col. 1 line 55 through col. 4 line 48). It is the Examiner's position that the additional salt of nitrogen-containing heterocyclic compound (excluding halide of nitrogen-containing heterocyclic compound) is the viscosity lowering agent.

Regarding claim 6, Wariishi et al. teaches the molten salt of iodide includes iodide of nitrogen-containing heterocyclic compound. (See Formulas 2-5, col. 1 line 55 through col. 4 line 8 )

Regarding claims 9-10, Wariishi et al. teaches the electrolyte composition containing water, wherein the content of water (or solvent) in the electrolyte composition is 10% or less. (See col. 19 lines 25-51)

Regarding claim 15, Kang et al. teaches in general a carboxylic acid on the  $TiO_2$  surface play a major role in variation of the photocurrent-voltage characteristics such as enhancing the stability, etc... (See Abstract of Kang et al.). Kang et al. tests several carboxylic acids based on increasing pKa and forms of acids, such as cyclic and aliphatic carboxylic acids, as seen in Table 1. Kang et al. only shows the test results of acetic acid ( $CH_3COOH$ ) and butyric acid ( $CH_3CH_2CH_2COOH$ ) in table 1. However, it would have been obvious to one skilled in the art at the time the invention was made to have propionic acid ( $CH_3CH_2COOH$ ) on a surface of the semiconductor electrode, because Kang et al. teaches a carboxylic acid can achieve the same result (See

Art Unit: 1795

abstract of Kang et al.) and propionic acid is the homolog of acetic acid and butyric acid. Compounds which are homologs (compound differing regularly by the successive addition of the same chemical group, e.g., by  $-CH_2-$  groups) are generally of sufficiently close structural similarity that there is a presumed expectation that such compounds possess similar properties. See MPEP 2144.09.

2. Claims 3 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kang et al. in view of Wariishi et al., and further in view of Gaudiana et al. (US Application Publication 20030188777)

Kang et al. in view of Wariishi et al. teaches a dye-sensitized as applied to claims 1-2, 4-5 and 9-15 above. Kang et al. and Wariishi et al. both suggest including gelling agent (See 1st paragraph of 2nd column on page 3049 of Kang et al.; and col. 19 line 53 through col. 20 line 23 of Wariishi et al.). Wariishi et al. also teaches using molten salt of iodide includes iodide of imidazolium compound. (See Formulas 2 and 4 of Wariishi et al. )

However, Kang et al. in view of Wariishi et al. does not specifically use the gelling agent such as polyvinyl pyridine, or molten salt of iodide such as 1-methyl-3-propyl imidazolium iodide.

With respect to claim 3, Gaudiana et al. teaches including a gelling agent such as polyvinyl pyridine in the electrolyte composition. (See paragraph 0081).

With respect to claim 7, Guadiana et al. teaches using molten salt of iodide includes iodide of nitrogen-containing heterocyclic compound such as 1-methyl-3-propyl imidazolium iodide (See Examples 11-12 and paragraph 0096).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Kang et al. in view of Wariishi et al. by including gelling agent such as polyvinyl pyridine and using molten salt of iodide such as 1-methyl-3-propyl imidazolium iodide as taught by Gaudiana et al., because Kang et al. suggests using gelling molecules to improve stability (See 1st paragraph of 2nd column on page 3049 of Kang et al.), Wariishi et al. suggests using imidazolium iodide in the electrolyte (See Formulas 2 and 4 of Wariishi et al.), and Gaudiana et al. teaches gelling agent is used to gel a suitable electrolyte solution (See paragraph 0081 of Gaudiana et al.) and molten salt of iodide of nitrogen-containing heterocyclic compound such as 1-methyl-3-propyl imidazolium would enhance the efficiency of the solar cell. (See Table 5 of Gaudiana et al.)

### ***Response to Arguments***

Applicant's arguments with respect to claims 1-7 and 9-14 have been considered but are moot in view of the new ground(s) of rejection.

Applicant argues that Wariishi et al. does not teach a viscosity lowering agent and the compounds discussed at col. 8 starting line 33 are not viscosity lowering agents but are the actual electrolytes. However, the Examiner respectfully disagrees. Claim 5 recites "the electrolyte composition further contains a viscosity-lowering agent

Art Unit: 1795

containing at least one compound selected from the group consisting of salt of nitrogen-containing heterocyclic compound and salt of aliphatic compound." Wariishi et al. teaches that, in addition to the salt of iodide, a salt containing anion such as  $N^-(CF_3SO_2)_2$ ,  $BF_4^-$ ,  $R_aCOO^-$ ,  $R_bSO_3^-$  ... and cation of a nitrogen-containing heterocyclic compound is also included in the electrolyte composition (See item 9 in col. 3). It is the Examiner's position that the salt of nitrogen containing heterocyclic compound (excluding halide of nitrogen-containing heterocyclic compound) is the viscosity lowering agent.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to THANH-TRUC TRINH whose telephone number is (571)272-6594. The examiner can normally be reached on 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.



Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TT  
7/16/2008

/PATRICK RYAN/  
Supervisory Patent Examiner, Art Unit 1795